Mechanisms of YidC-mediated Insertion and Assembly of Multimeric Membrane Protein Complexes

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Published in:
The Journal of Biological Chemistry

DOI:
10.1074/jbc.R800029200

Publication date:
2008

Supplemental Figure legends

Fig. 1 Topology models of substrates of YidC and the membrane integral F_0 subunits of the ATP synthase. (a) CyoA and M13 procoat are synthesized as precursors. The asterisk denotes the signal peptidase cleavage site. An N-terminal cysteine in CyoA is lipid modified in the mature protein, which is subsequently incorporated into the cytochrome *o* oxidase complex. After membrane insertion, Pf3 coat and mature M13 coat assemble into the phage progeny. MscL assembles into a homopentamer and helps cells survive osmolytic stress by sensing lateral membrane pressure. (b) The F_0 domain of the *E. coli* F_1F_0 ATP synthase consists of the subunits F_0a, F_0b and F_0c. In brackets the names of the homologous proteins in yeast are given.

Fig. 2 Models for YidC mediated insertion of membrane proteins. (a) Membrane insertion of CyoA can be subdivided into two sequential and independent steps. First, the signal sequence and TMS1 are inserted into the membrane by YidC as a hairpin-type structure while the remainder of the protein is tethered to the ribosome. Next, the second TMS and periplasmic domain are translocated, requiring the concerted action of SecYEG and SecA. Membrane insertion of (b) M13 procoat and (c) F_0c solely depends on the insertase activity of YidC. The translocation of the highly negatively charged loop of M13 procoat is strongly stimulated by the PMF. Common principles in these processes are the YidC mediated recognition and topogenesis through positive charges and the hydrophobic partitioning and helical hairpin formation of the TMSs.

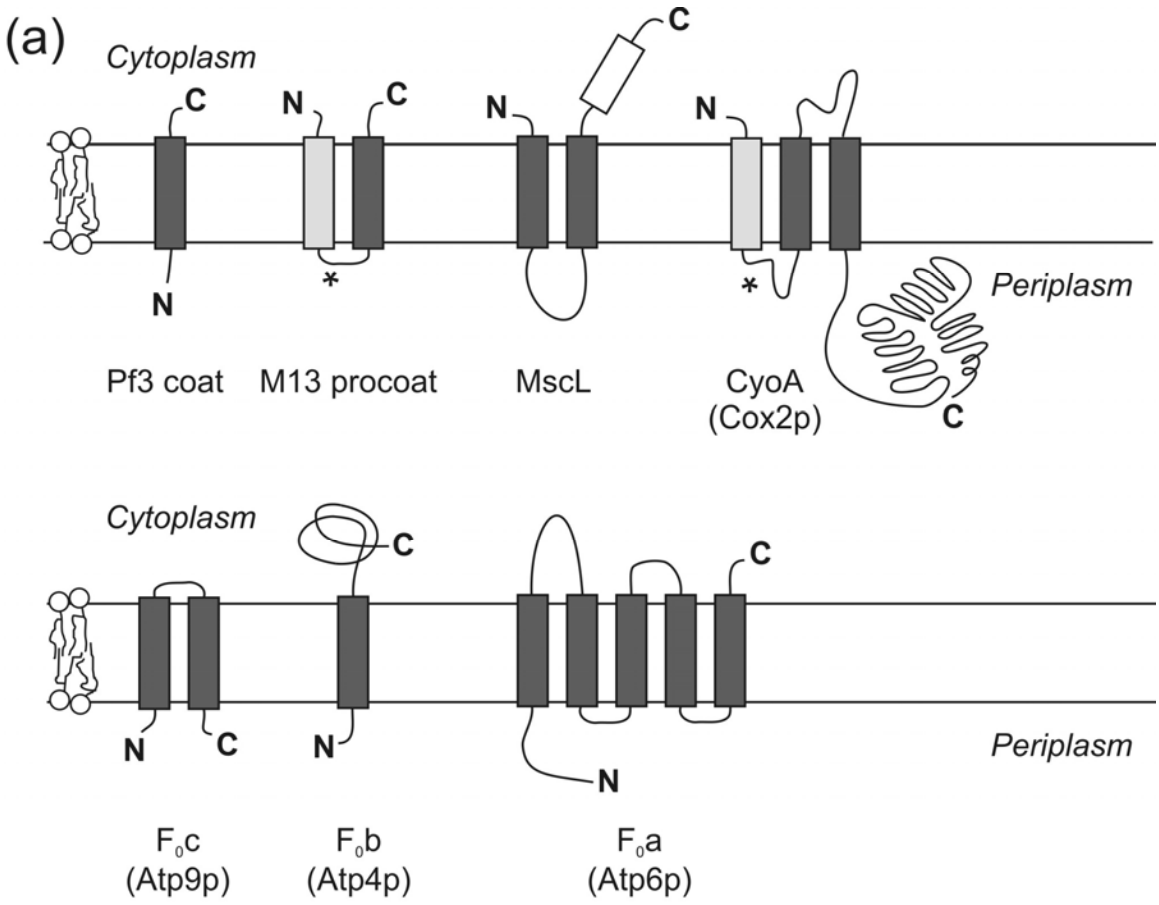
(a)
Cytoplasm
C
N
C
N
C
N
N
C
*
*
Periplasm
Pf3 coat
M13 procoat
MscL
CyoA
(Cox2p)
C
Cytoplasm
C
C
N
C
N
N
Periplasm
F0c
(Atp9p)
F0b
(Atp4p)
F0a
(Atp6p)

Fig. 1

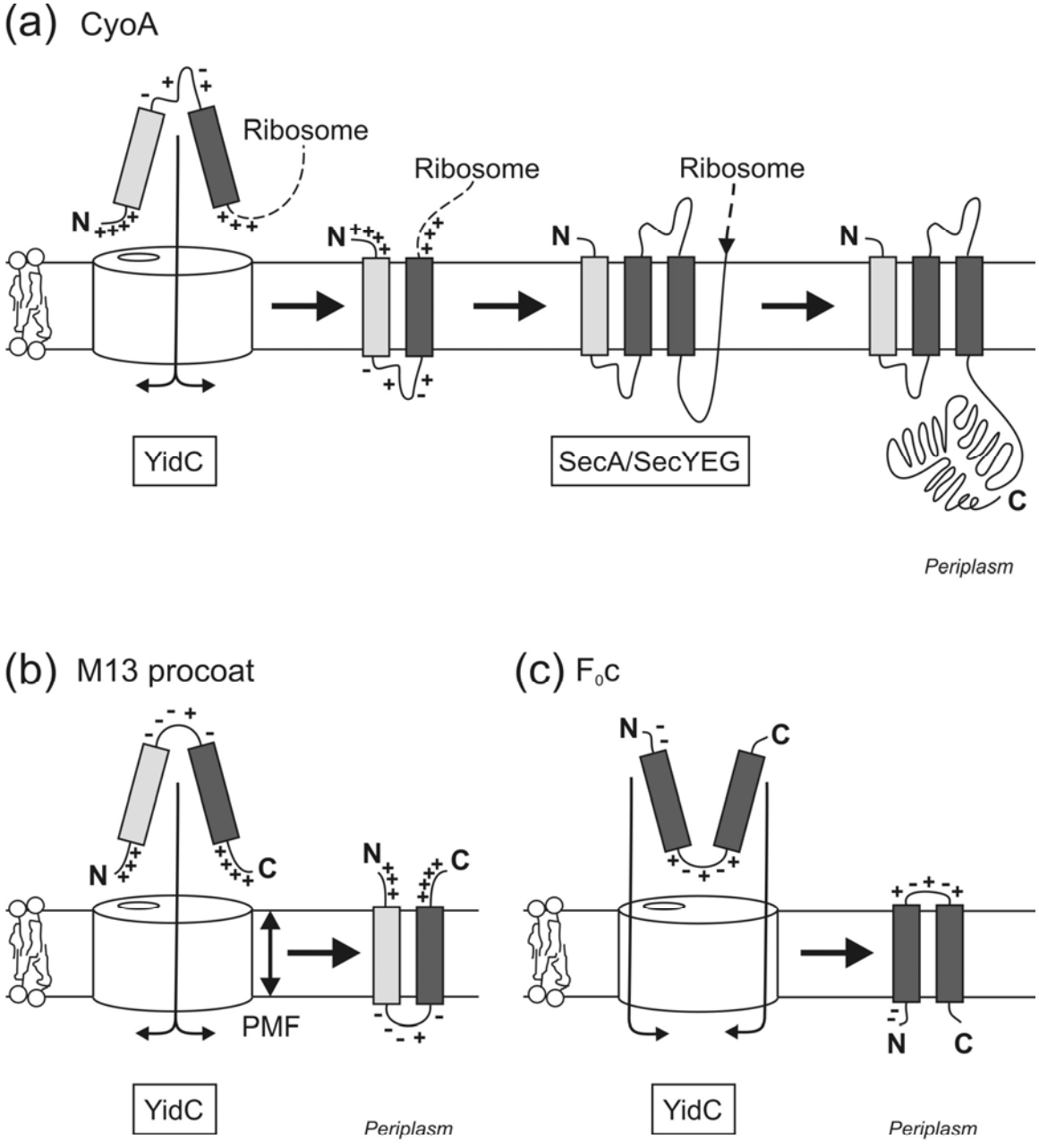
(a) CyoA
Ribosome
Ribosome
Ribosome
N
N
N
N
YidC
SecA/SecYEG
C
Periplasm
(b) M13 procoat
N
C
N
C
PMF
YidC
Periplasm
(c) F0c
N
C
N
C
YidC
Periplasm

Fig. 2